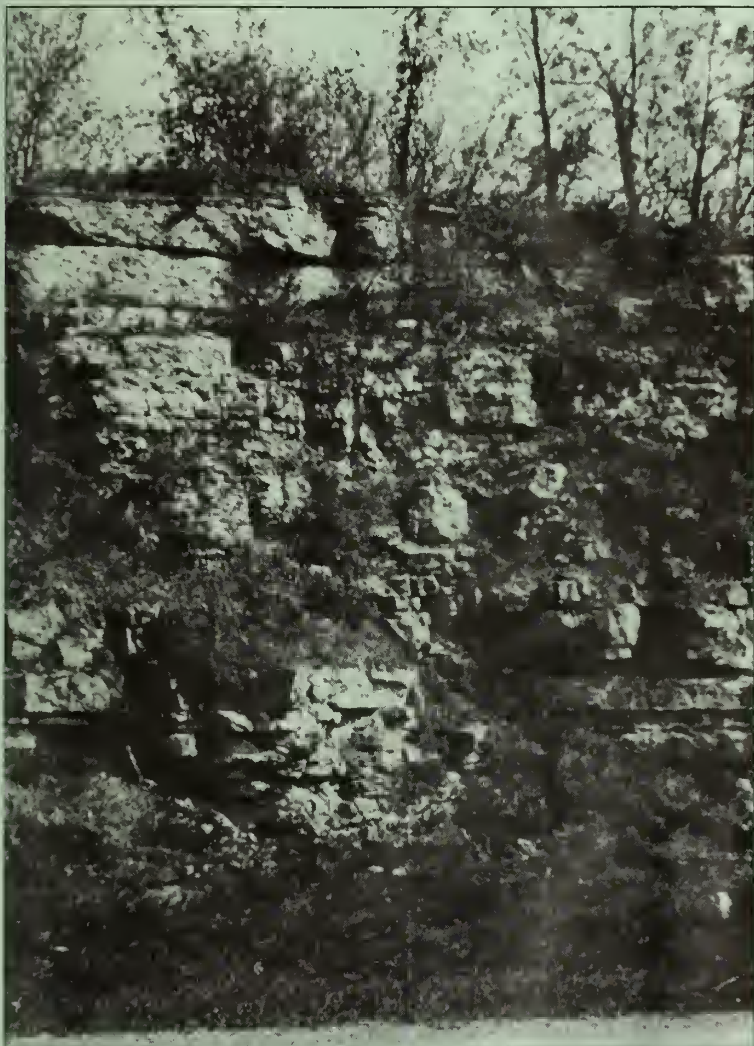
Geol Survey

A Guide to the Geology of the Elizabeth Area



David Reinertsen

Field Trip 1985B
May 18, 1985

Department of Energy and Natural Resources
STATE GEOLOGICAL SURVEY DIVISION
Champaign, Illinois 61820

ELIZABETH GEOLOGICAL SCIENCE FIELD TRIP

Miles to next point	Miles from starting point	
0.0	0.0	Assemble on West Street heading northeast in front of the high school.
0.1+	0.1+	STOP (1-way); T-intersection with West Main Street. TURN LEFT (northwesterly) and descend hill.
0.25-	0.35	To the right in the roadcut is dolomite of the Ordovician Galena Group. There will be a number of exposures of this dolomite. West Main Street becomes South Georgetown Road in this vicinity.
0.15	0.5	Ahead and slightly to the right, on the north side of Apple River, are some large blocks of the Galena that have slumped and slid down the slope.
0.1	0.6	CAUTION; narrow one-lane bridge across Apple River.
0.05	0.65	BEAR LEFT and ascend hill. The road is so steep here because it is across the exposed edges of the resistant Galena dolomite.
0.1+	0.75+	More Galena dolomite is exposed to the left in the roadcut.
0.15-	0.9	To the right is more Galena dolomite in the roadcut.
0.75	1.65	STOP (1-way); T-intersection with Elizabeth-Scales Mound blacktop. TURN RIGHT (northerly) on the blacktop. CAUTION: visibility is somewhat restricted to the left.
0.25	1.9	The upland slopes here are underlain by the Ordovician Maquoketa shale. The ridge tops in the distance, both right and left, are capped by Silurian dolomite which is quite resistant to erosion and, therefore, protects the underlying shale.

Miles to next point	Miles from starting point	
0.65	2.55	This roadcut is in Maquoketa siltstones and silty shales. The west side (left) shows considerable evidence of slumping because of the weak bedrock and overlying surface materials here. CONTINUE AHEAD.
0.7-	3.25-	To the left in the field are large blocks of Silurian dolomite that are remnants of a former, thicker, more extensive bedrock cover across this area.
0.25+	3.5	A good scenic view, both to the right and the left.
0.2	3.7	This roadcut also shows the thin bedded siltstones and shales in the Maquoketa Group.
0.3	4.0	Just behind the house to the left is an exposure of the Silurian dolomite that caps and protects this hill. The roadcut on either side has the upper part of the Maquoketa present and some of the lower Silurian rocks but they are fairly well covered up by some slump of suface materials and vegetation. CONTINUE AHEAD (north).
0.35+	4.35+	To the left is the route of the old road around this knob. Silurian dolomite exposed in the roadcut. Notice how slabby and rubbly it appears after it weathers. Where the rock is fresher, some of it appears to be quite massive. The lower portion (Mosalem Formation) is more thin bedded as it weathers than the upper portion (Tete des Morts Formation).
0.25-	4.6	STOP 1. Silurian dolomite of the Mosalem and Tete des Morts Formations and giest, a deep red residual clay with a lot of chert in it, exposed on both sides of the roadcut. CAUTION: Fast traffic; park well off the blacktop.
0.0	4.6	Leave Stop 1; PROCEED (northward) and PREPARE TO TURN RIGHT.
0.2-	4.8-	TURN RIGHT (east) at T-road, East Hoffman Road.

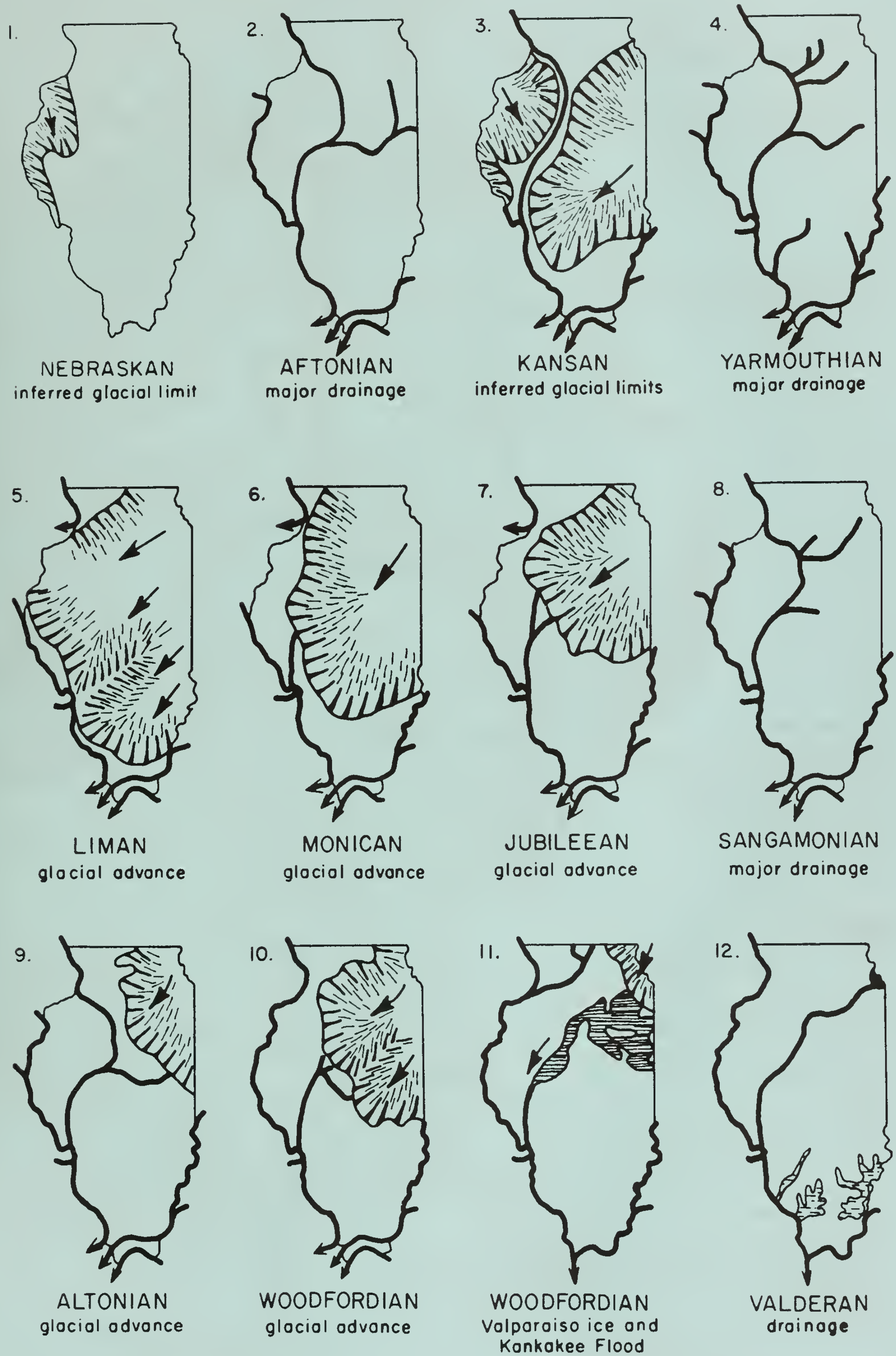
Miles to next point	Miles from starting point	
0.05+	4.85	STOP 2 is below the house at the crest of the road east of the stop sign. Scenic overlook and discussion of peneplains.
0.0	4.85	Leave Stop 2. CONTINUE AHEAD (eastward).
0.1	4.95	Blocks of Silurian Tete de Morts dolomite have slid down the slope here.
0.1	5.05	Part way around the curve note the small flat areas on both sides of the road. These are probably developed on the lower part of the Mosalem dolomite. The gentle slopes below the flat areas are underlain by the Maquoketa.
0.65+	5.7+	Y-intersection. BEAR RIGHT on Hoffman Road, a gravel road.
0.35	6.05+	The high ground in the distance to the south is Terrapin Ridge, which is just east of Elizabeth. That ridge is capped by Silurian dolomite and is slightly more than 1040 feet (msl) in height.
0.25-	6.3-	T-road from left, Hoffman Road. CONTINUE AHEAD (southerly) on Goosehollow Road and descend the hill.
0.1+	6.4+	The road becomes very steep and rough as it descends across the exposed edges of Galena dolomite ledges.
0.05	6.45	To the left, Galena dolomite is exposed in the roadcut.
0.4	6.85	CAUTION: the sides of several small culverts ahead are not marked very well--tall grass and weeds may cover them. The valley bottom here is quite wide for such a small stream.
0.85	7.7	Y-intersection from right, East Shaw Road. BEAR LEFT, South Goosehollow Road.
0.05+	7.75+	Cross narrow bridge and BEAR RIGHT. To the left is a small, low terrace remnant.
0.25-	8.0	STOP 3. A discussion of the history of Apple River.

Miles to next point	Miles from starting point	
0.0	8.0	Leave Stop 3. CONTINUE AHEAD (east and south).
0.15	8.15	To the left is another view of the terrace, that is about 5 feet higher than the general floodplain level here.
0.05+	8.2+	CAUTION, sharp right turn and narrow one-lane old iron bridge across Apple River.
0.05+	8.25+	CAUTION: road intersection. BEAR RIGHT onto Apple River Road and CONTINUE (south and westerly).
0.35-	8.6	CAUTION: ascend the hill; precipitous drop on the right into Apple River. Note slumping to the left.
0.1	8.7	STOP 4. Discussion of slumping of Galena Group dolomite and surface materials. CAUTION: The road is narrow here. Park as far to the right as you can safely.
0.0	8.7	Leave Stop 4 and CONTINUE AHEAD (southwesterly).
0.55+	9.25+	More slumping of the Galena dolomite to the left. However, the stone becomes more coherent and massive southwestward across the roadcut.
0.3	9.55+	Enter outskirts of Elizabeth.
0.5-	10.05+	TURN RIGHT (northwest) on North Washington Street.
0.1+	10.15+	CONTINUE AHEAD (west) at St. Mary's Church.
0.05+	10.25-	TURN LEFT (south) on North Vine Street.
0.05+	10.3	STOP; "5 points" crossroads. Intersection with U.S. 20 and West Main Street. TURN RIGHT (west) on West Main Street.
0.15-	10.45-	TURN LEFT (southwest) on West Street.
0.15	10.6-	TURN RIGHT and enter the parking lot. STOP 5. Lunch. Resume mileage figure here after lunch.
0.0	10.6-	Leave Stop 5. TURN LEFT (northeasterly) on West Street and retrace part of itinerary.

Miles to next point	Miles from starting point	
0.15	10.75-	STOP (1-way); T-intersection. TURN RIGHT (northwesterly) on West Main Street and descend the hill.
0.5	11.25-	CAUTION. Cross narrow one-lane old iron bridge across Apple River. Ascend the hill on the other side.
0.2+	11.45	To the right across the fence is a small indentation in the slope and a small amount of debris that might possibly have been a prospct hole for lead.
0.6	12.05	STOP 6. View of the Haggerty Mining and Development Company site and discussion of lead mining in the Elizabeth area.
0.0	12.05	Leave Stop 6 and CONTINUE AHEAD (northwest).
0.05+	12.1+	To the right across the fence are a couple of shallow sags in the slope that might possibly be old prospect pits.
0.15	12.25+	The view to the northeast is of a farm with three silos. Up the hill to the left are a couple of small spoil piles; to the right up the hill on the other side of the valley is a larger spoil pile beneath a tree. These are old diggings along a crevice filling of lead. The abandoned Wishon Mine shaft was located near the larger pile.
0.05-	12.3	STOP (1-way); South Georgetown Road and Elizabeth-Scales Mound Road. CAUTION--TURN RIGHT (north) and PREPARE TO TURN LEFT IMMEDIATELY.
0.05+	12.35+	TURN LEFT (westerly) on South Georgetown Road.
0.45-	12.8+	TURN LEFT at T-road intersection onto West Longhollow Road. After making the turn, note to the right up on top of the Silurian ridge is an observation tower that is the last stop of this field trip.
0.15	12.95+	To the left, massive beds of Galena dolomite protrude from the hillside. The gentle slopes above are developed on the overlying Maquoketa shale.

Miles to next point	Miles from starting point	
0.2+	13.15+	STOP 7. Discussion of meander loops in Furnace Creek to the right of the road.
0.0	13.15+	Leave Stop 7 and CONTINUE AHEAD (southerly).
0.1-	13.25+	To the left in the plowed field is another terrace that is some 5 to 6 feet above the normal floodplain of Furnace Creek.
0.1	13.35+	CAUTION: narrow concrete bridge. CONTINUE AHEAD and BEAR LEFT.
0.1	13.45+	To the left along the east valley wall of Furnace Creek are a number of large blocks of Galena dolomite that have slid downslope.
0.7	14.15+	STOP 8. Discussion of quarry in the Wise Lake Formation, Galena Group. Entrance to E. Wienen and Sons Quarry.
		Note: You <u>must</u> have permission to enter this property.
0.0	14.15+	Leave Stop 8 and CONTINUE AHEAD (south).
0.15	14.3+	STOP (2-way); crossroad. Intersection of West Longhollow Road with U.S. 20 West. TURN LEFT (west) on U.S. 20 and ascend hill through roadcut in Wise Lake dolomite.
0.15	14.45+	The slopes here are underlain by Maquoketa shale.
0.5	14.95+	CAUTION: Y-intersection with Illinois 84 (The Great River Road). BEAR RIGHT on U.S. 20 West and ascend "Silurian" ridge.
0.65	15.6+	To the right is the Lookout Tower.
0.1	15.7+	PREPARE TO TURN RIGHT.
0.15-	15.85	TURN RIGHT at entrance to Lookout Tower and park where convenient.
		STOP 9. Discussion of landscape in field trip area.
		End of field trip.

SEQUENCE OF GLACIATIONS AND INTERGLACIAL DRAINAGE IN ILLINOIS



(From Willman and Frye, "Pleistocene Stratigraphy of Illinois," ISGS Bull. 94, fig. 5, 1970.)

ILLINOIS STATE GEOLOGICAL SURVEY

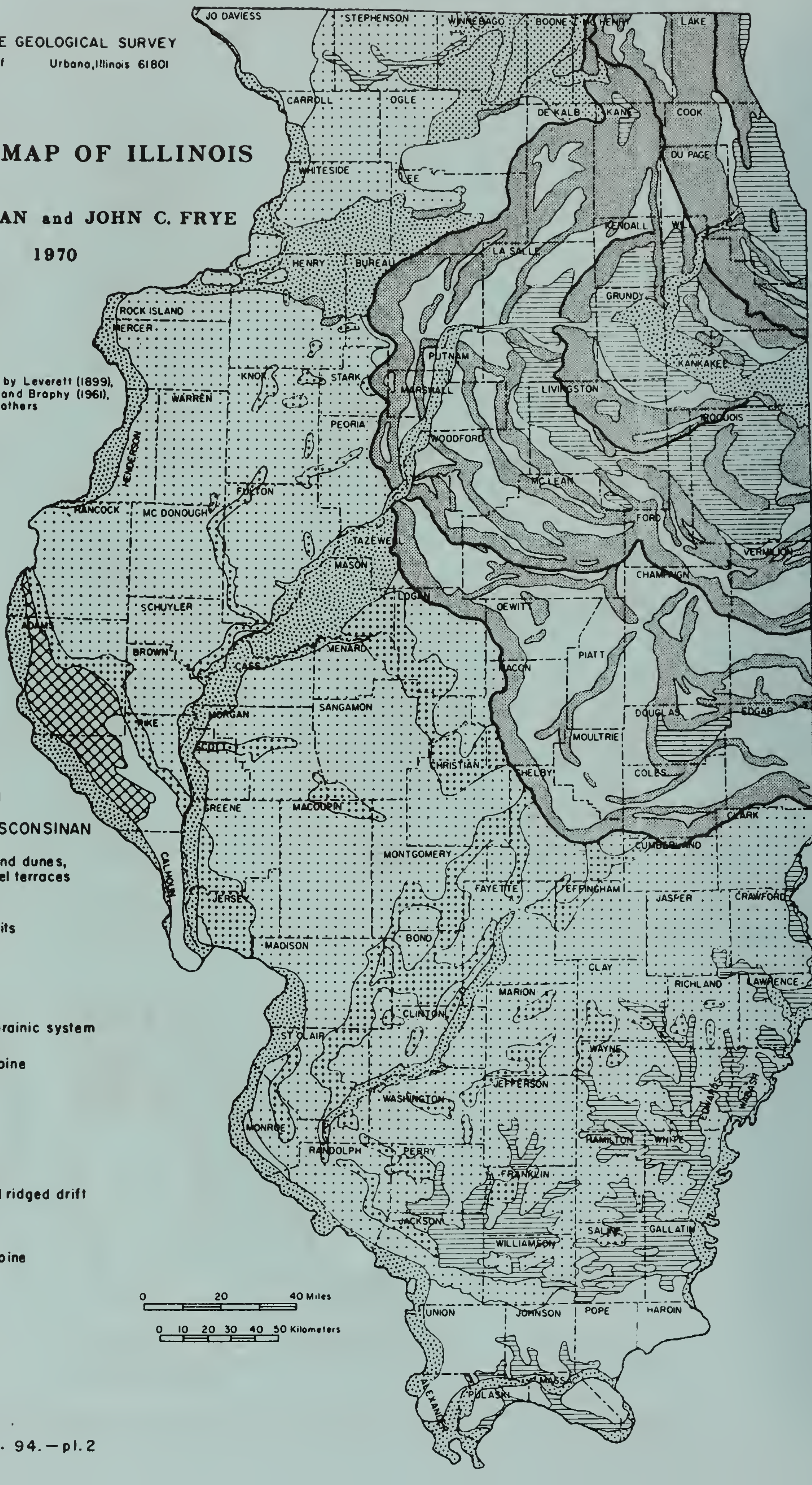
John C. Frye, Chief   Urbana, Illinois 61801

GLACIAL MAP OF ILLINOIS

H.B. WILLMAN and JOHN C. FRYE

1970

Modified from maps by Leverett (1899), Ekblaw (1959), Leighton and Brophy (1961), Willman et al. (1967), and others



EXPLANATION

HOLOCENE AND WISCONSINAN

Alluvium, sand dunes, and gravel terraces

WISCONSINAN

Lake deposits

WOODFORDIAN

Moraine

Front of morainic system

Groundmoraine

ALTONIAN

Till plain

ILLINOIAN

Moraine and ridged drift

Groundmoraine

KANSAN

Till plain

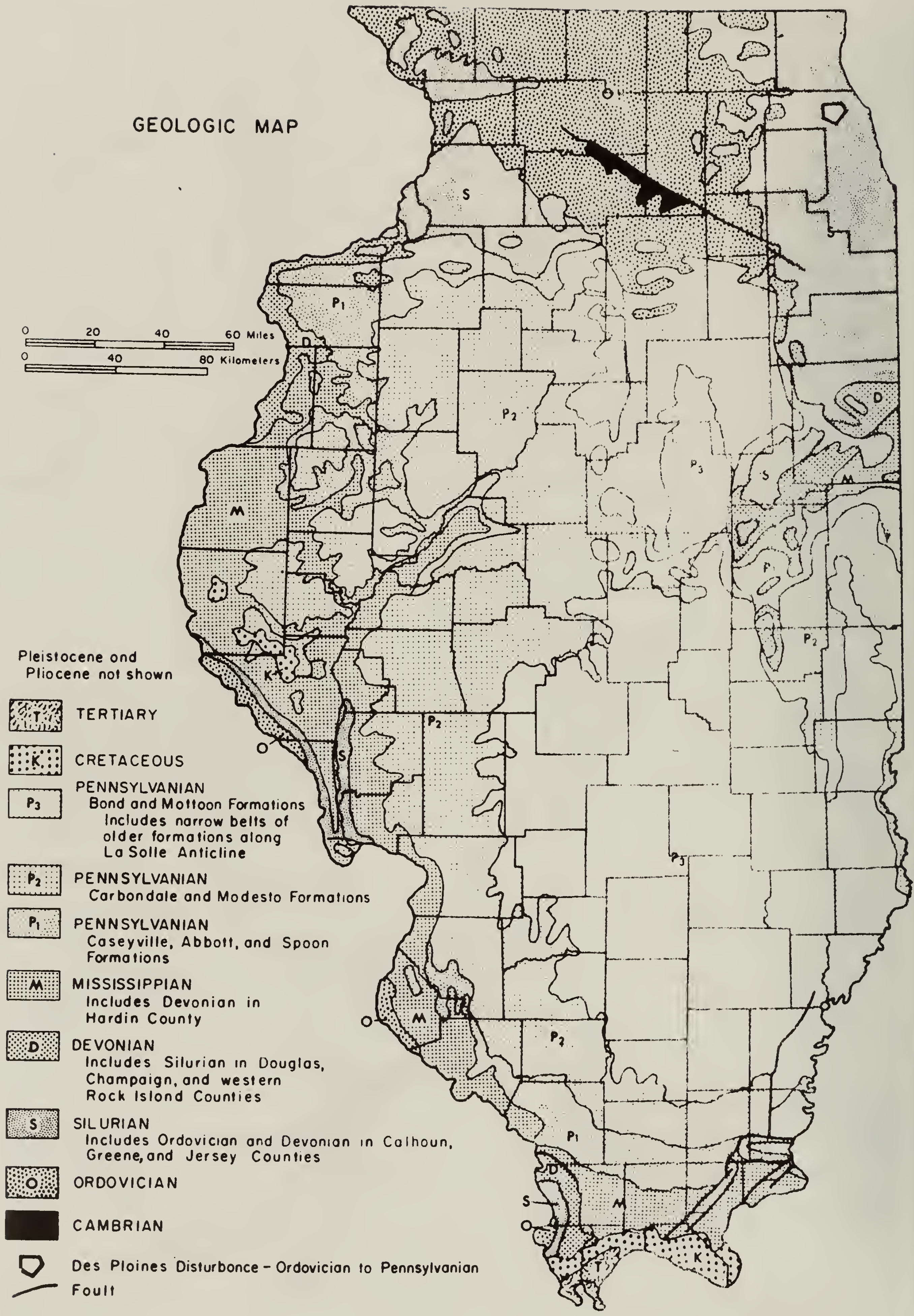
DRIFTLESS

Modified from Bull. 94.—pl.2

PHYSIOGRAPHIC DIVISIONS OF ILLINOIS

Reprinted 1978

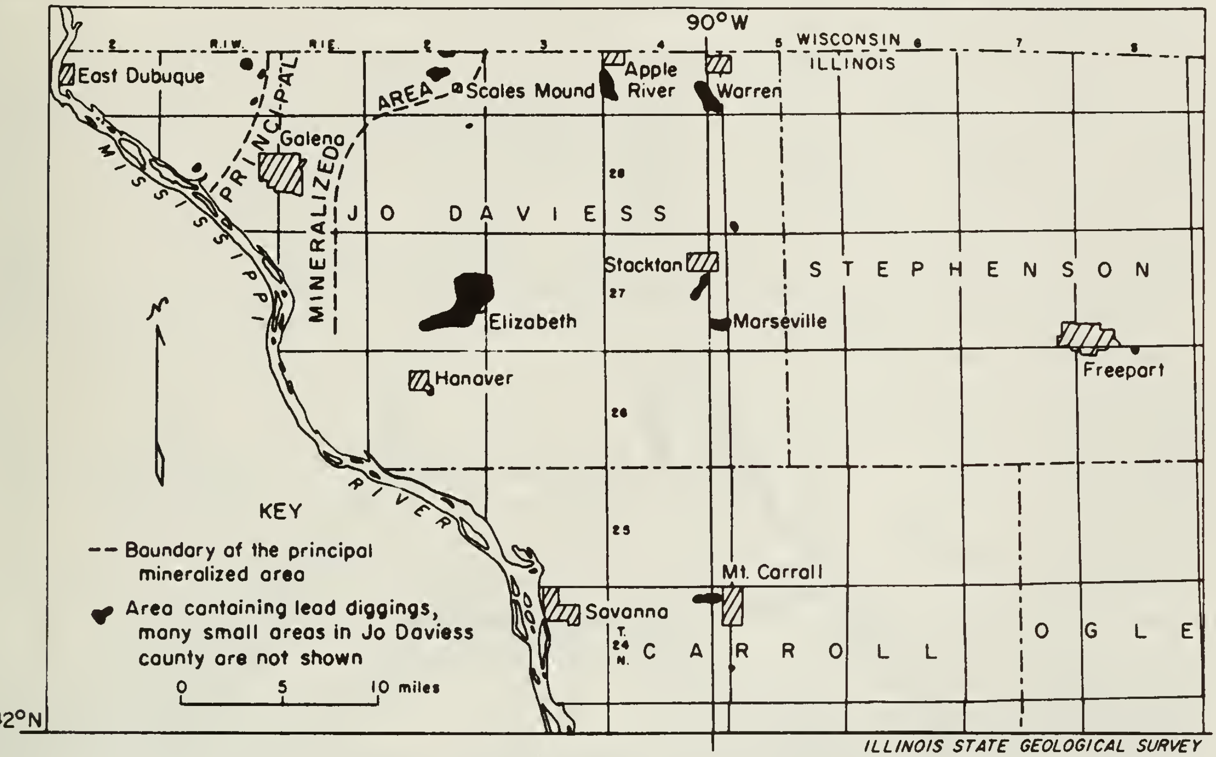
ILLINOIS STATE GEOLOGICAL SURVEY


GEOLOGIC MAP
0 20 40 60 Miles
0 40 80 Kilometers
Pleistocene and Pliocene not shown
T TERTIARY
K CRETACEOUS
P3 PENNSYLVANIAN Bond and Mattoon Formations Includes narrow belts of older formations along La Salle Anticline
P2 PENNSYLVANIAN Carbondale and Modesto Formations
P1 PENNSYLVANIAN Caseyville, Abbott, and Spoon Formations
M MISSISSIPPIAN Includes Devonian in Hardin County
D DEVONIAN Includes Silurian in Douglas, Champaign, and western Rock Island Counties
S SILURIAN Includes Ordovician and Devonian in Calhoun, Greene, and Jersey Counties
O ORDOVICIAN
CAMBRIAN
Des Plaines Disturbance - Ordovician to Pennsylvanian
Fault

THE ZINC-LEAD DEPOSITS OF NORTHWESTERN ILLINOIS

Location

The principal mineralized area in which the zinc-lead deposits in northwestern Illinois have been found occurs in Jo Daviess County in a belt from 5 to 10 miles wide and 15 miles long, extending approximately northeast through Galena from the Mississippi River to the Wisconsin line. Lead ore has been mined at other places in Jo Daviess County, such as near Elizabeth, Apple River, and Warren. These occurrences increase the known mineralized district to include most of the county. Small amounts of lead ore are also reported to have been mined outside of this area near Freeport in Stephenson County and near Mt. Carroll in Carroll County.



Zinc-lead district of northwestern Illinois.

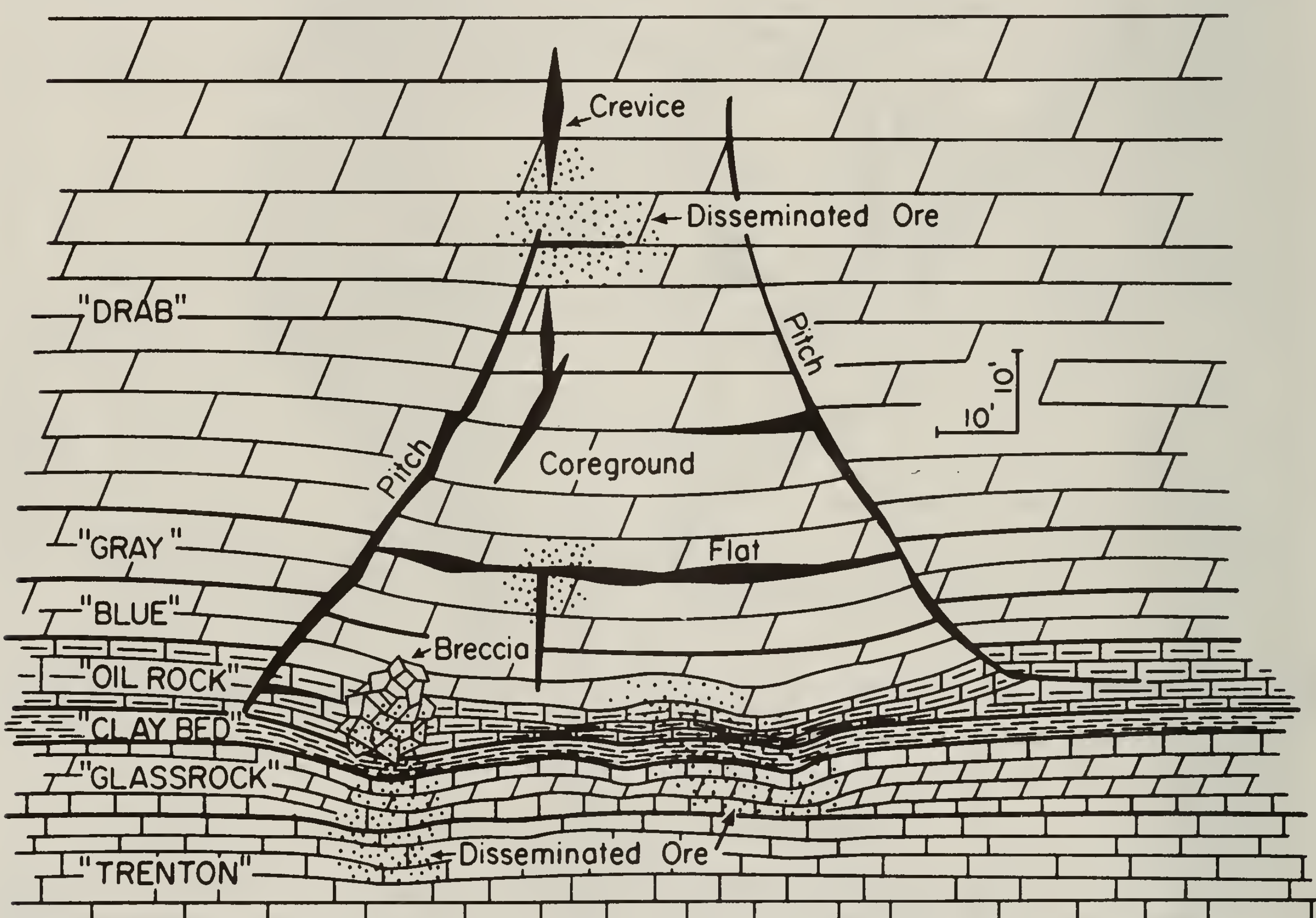
Stratigraphic Position of Ore Deposits

The zinc-lead ore deposits occur in the middle Ordovician carbonate formations of the Galena and Platteville Groups (Champlainian Series) of the Ordovician System. The major deposits of zinc ore (sphalerite) are found in the lower part of the Galena Group, which includes the "Drab," "Gray," and "Blue" zones of the Dunleith Formation; the "Oilrock," or Guttenberg Formation; the "Claybed," or Spechts Ferry Formation; and in the "Glassrock," or Quimbys Mill Formation, which is in the top of the Platteville Group. These deposits are mainly of the "flat-and-pitch" type.

The major deposits of lead ore (galena) containing little associated sphalerite are found principally in the upper part of the Galena Group, which includes the top half of the Dunleith ("Drab") and the overlying Wise Lake Formation ("Buff"). These deposits are of the "crevice" type. Locally the lead ore may grade into mixed lead-zinc ore, especially in the lower part of the Wise Lake Formation.

Flat-and-Pitch Deposits

The flat-and-pitch deposits in the lower ore-bearing zone consist of "flats," which are nearly horizontal, sheet-like bodies of ore between or parallel to the bedding planes of the strata, and "pitches," which are similar bodies cutting across the bedding planes. The pitches usually slope more than 45 degrees and many steepen upward to grade into vertical crevices. Some tend to flatten downward. The mineralized rock between pitches bounding an ore body is called the "coreground."



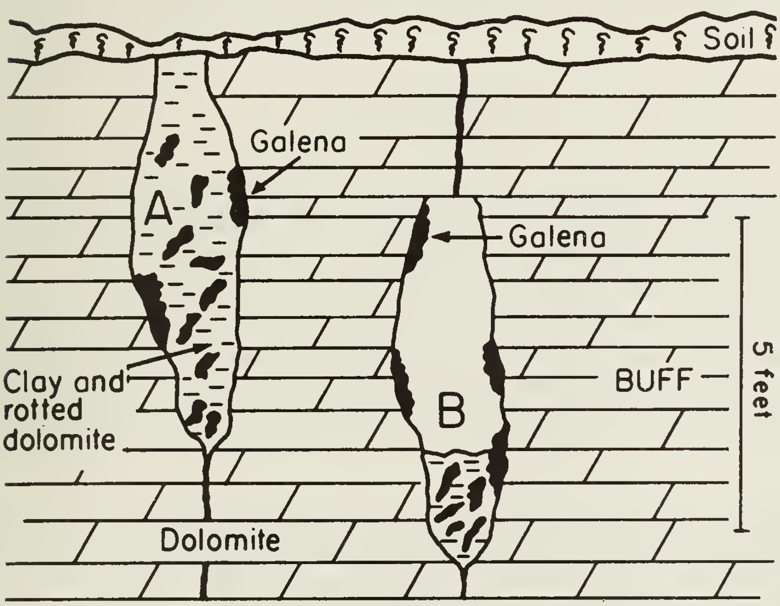
Flat-and-pitch ore bodies.

The flat-and-pitch deposits are associated with small synclinal structures, which trend northwest, northeast, or east. Between pitches bounding an ore body, the "Oilrock" and "Glassrock" are thinner than usual, apparently because of being dissolved away, and the overlying strata have sagged to form the synclinal structure. This sagging opened up the fractures which became mineralized. The mineralized sags are usually 50 to 200 feet wide, but may be as wide as 300 feet,

and extend longitudinally for thousands of feet in a straight line or in an arcuate manner. Usually the minable thickness is about 40 feet, but sometimes it is thicker. There are many variations in the shape and character of these deposits. The ore generally occurs as filled fissure deposits, but in the "Oil-rock" and "Glassrock" there are also disseminated-type deposits. Rarely the ore will assay as high as 20 percent zinc, but 10 percent zinc is considered rich ore and 3 to 4 percent ore is considered minable. In some deposits, minable ground is confined entirely to the pitches, but usually parts of the coreground are also minable. Minerals, other than galena, associated with the zinc ore (sphalerite) include pyrite, marcasite, and calcite. Above the water table, where oxidation has occurred, there are secondary minerals including cerussite (lead carbonate), anglesite (lead sulfate), smithsonite (zinc carbonate), and limonite (iron oxide).

Crevice Deposits

The crevice deposits of the upper mineralized zone occur as fissure fillings along joints that are oriented mainly in an east-west direction. The crevices are actually vertical fissures, or cavities, that were opened up along the joints by solution of the dolomite. Along a typical crevice the minable ore occurs as pods or lenses a few feet to a few hundred feet long scattered along the strike of the joints. The ore bodies are generally only a few inches to a few feet wide, but where there are two or more closely spaced crevices, they extend over widths of 30 feet or more. The ore is usually pure galena, but locally it may grade to mixtures of galena and sphalerite.



Crevice ore bodies. Crevice A reaches the ground surface and is filled with clay; B is only partly clay-filled.

The shallow crevice deposits were the nation's principal source of lead ore between 1820 and 1865. These deposits were easily discovered in partial exposures along stream valleys and by the presence of residual accumulations of ore where erosion had intersected mineralized joints. In some cases the topographic expression of crevices as shallow depressions led to the discovery of ore bodies. When these easily exploited deposits were depleted, lead ore production declined sharply. At present, little ore is mined from shallow deposits each year. Zinc ore obtained almost exclusively from the larger, deeper flat-and-pitch deposits is now the chief mineral commodity of the area.

Origin of Ore Deposits

The origin of the ore bodies is still in question. An early theory that was widely accepted is the "cold water theory." By this theory the lead and zinc minerals were assumed to have been present in trace quantities disseminated throughout the Galena Dolomite or higher rock units. The lead and zinc were originally supposed to have been deposited with the carbonate rocks when they were precipitated from the ancient Ordovician sea more than 400 million years ago. Percolating ground water then dissolved the lead and zinc minerals from these rocks and carried them downward to be reprecipitated in openings in the strata where the ore is now found.

The theory now generally favored by geologists is the "magmatic theory." According to this theory the ore was emplaced by hydrothermal solutions rising from a deep magmatic (igneous) source. The warm mineralized solutions ascended until they encountered the cavernous, jointed Champlainian (middle Ordovician) rocks that had the proper temperature-pressure conditions to allow the precipitation of the lead and zinc sulfides. The neutralizing effect of carbonate-rich ground water on the acid sulfide-bearing solutions could also have been partly responsible. These ideas may explain why the ore bodies are restricted to such a narrow vertical interval of Ordovician strata. However, the absence of deep downward extensions of ore and major faults that could have provided access to the rising solutions has not been resolved.

The open fissures in which the crevice ores were deposited and the synclinal structures associated with the flat-and-pitch ore bodies are solutional in origin and were formed before ore emplacement. Whether solution was by meteoric ground water or by hydrothermal solutions has not been definitely determined. If the latter is true, the openings may have formed contemporaneously with ore deposition.

Prospecting for Ore Deposits

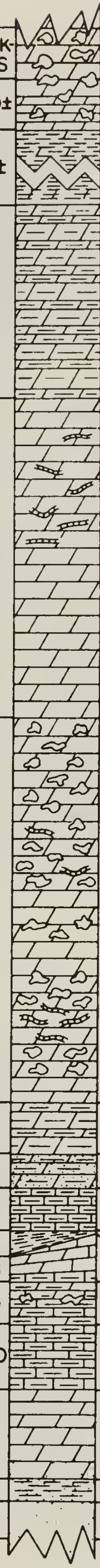
The long, fairly narrow ore bodies in the Upper Mississippi Valley zinc-lead district, especially the deeper ore bodies, are difficult to find. To extend the life of the mining district new reserves of ore must be found. Geophysical and geochemical methods have been used in the exploration for ore deposits to some extent, but with limited success. Drilling is the most commonly used means of prospecting for lead and zinc ores and is at present the most effective method of searching for the deep ore bodies. Drilling is used to explore the trends of known ore deposits and to search for new ore bodies in previously untested areas.

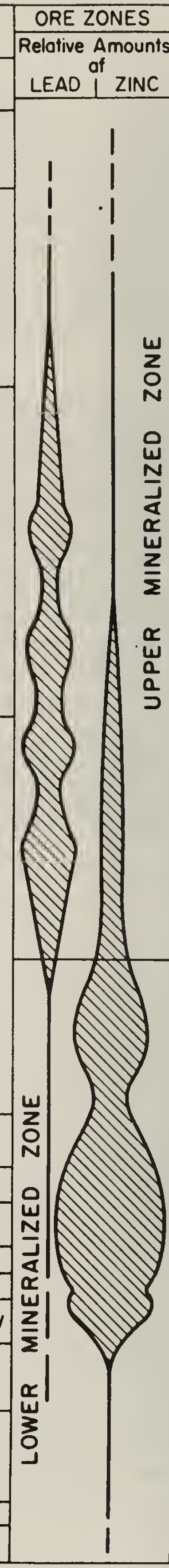
Recent prospecting for lead and zinc ores in northwestern Illinois has consisted largely of drilling in areas of old shallow lead diggings, along the trends of known deeper ore bodies, and in the vicinities of the occasional water wells that happen to penetrate ore. "Wildcat" holes drilled in unproven ground outside areas of known ore deposits have been relatively few. Before deciding where to drill such exploratory holes, many interrelated geologic factors must be evaluated by the geologist.

Churn drilling. There are two principal methods of drilling deep holes—churn drilling and rotary drilling with a diamond bit. Churn drilling, also known as cable-tool drilling, is much less expensive than diamond drilling and has been used widely in the zinc-lead district for deep prospecting. By this method six-inch vertical holes are drilled by a heavy steel rock bit suspended from a steel cable that is attached to the controlling machinery at the surface. The heavy bit is alternately lifted and dropped, the rock being penetrated by the repeated blows of the bit. The broken rock is periodically bailed from the hole, and samples of the rock chips are saved for examination or assaying.

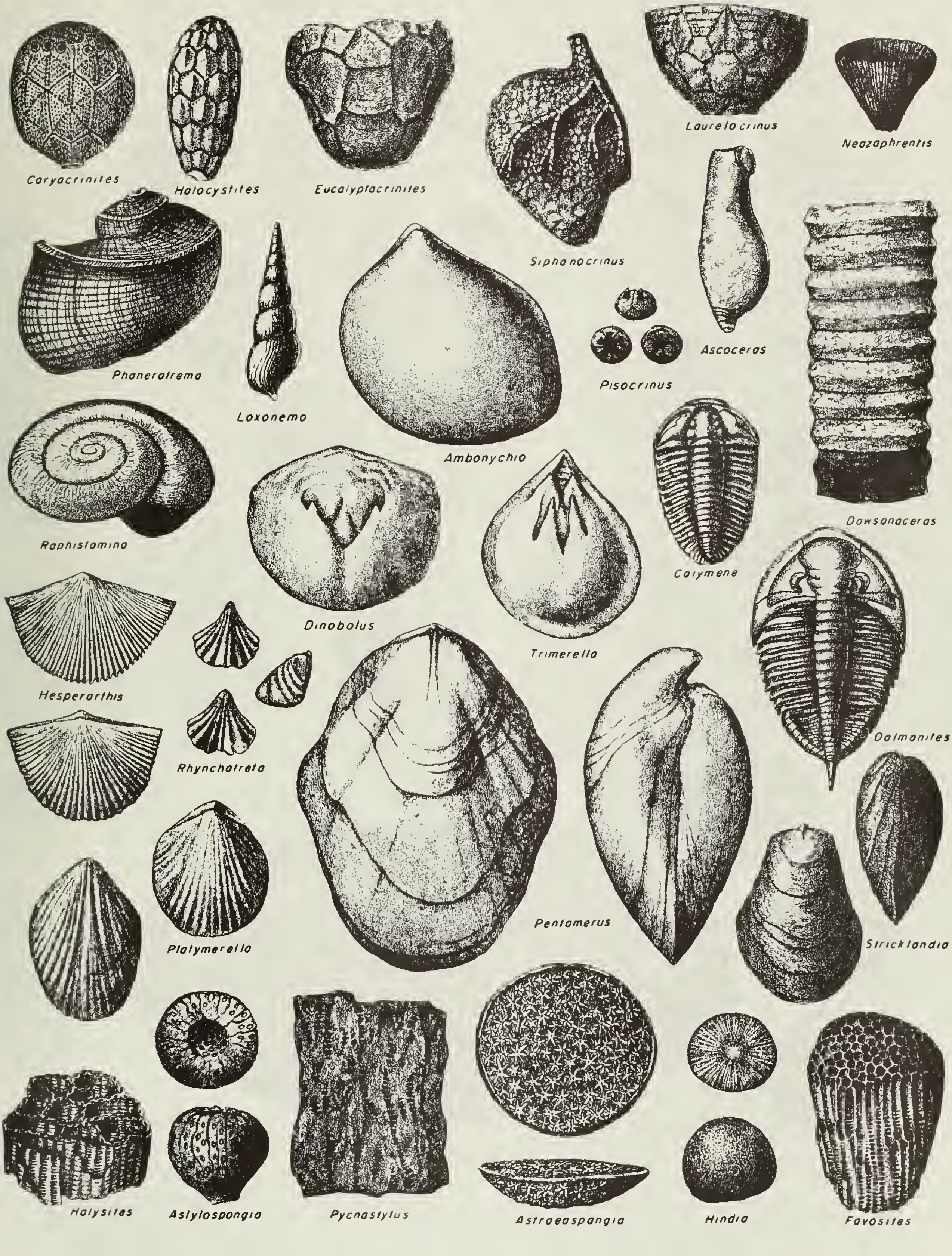
Diamond drilling. Diamond drilling provides better rock samples than those obtained by churn drilling, if core recovery is good. The cores obtained are continuous samples, or a column, of the rock interval that is penetrated by the bit. However, in soft or fractured rock, often in critical zones of mineralization where samples are most desired, poor core recovery may result in no sample for some intervals. A definite advantage of diamond drilling is the ability to drill inclined holes. Drilling is accomplished by means of a small-diameter diamond bit attached to a column of pipe called the drill stem. The bit cuts through the rock when the drill stem is rotated by power machinery at the surface. Water or a water-oil mixture is pumped down the inside of the drill stem under pressure to cool and lubricate the diamond bit and to flush out crushed rock from the bottom of the hole and carry it up the drill hole to the surface. The rock core enters the hollow drill stem, where it is surrounded by the coolant as the bit cuts downward, and it remains there until it is retrieved when the drill stem is pulled out of the hole. Depending upon the depth to be drilled, the diameter of the drill stem and bit are usually decreased periodically as the hole deepens.

SYSTEM	GROUP	FORMATION	MINING TERMS	THICKNESS	DESCRIPTION OF STRATA
Silurian				200±	Dolomite, gray, cherty, shaly
Ordovician	Maquaketa			110±	Shale, greenish gray; some dolomite
	Galena	Dubuque	"Buff"	45	Dolamite, grayish tan, shaly
		Wise Lake		75	"Upper Receptoculites Zone" Dolomite, tan
		Dunleith	"Drab"	105	"Middle Receptaculites Zone" Dolomite, brawnish gray, cherty "Lower Receptaculites Zone"
			"Gray"	12	Dolomite, gray, shaly
			"Blue"	8	Dalamite, blue-gray, shaly, sandy
		Guttenberg	"Oil rock"	2-16	Limestane, brown, gray, shaly
		Spechts Ferry	"Clay bed"	0-6	Shale, green, limy
	Platteville	Quimbys Mill	"Glass rock"	1-18	Limestane & Dolomite, brawn
		Grand Detour	"Trenton"	5-15	Limestane & Dolomite } gray, shaly, cherty
		Mifflin		10-20	Limestone, gray, shaly
		Pecatanica	"Lower Buff"	20	Dolomite, brownish gray
	Ancell	Glenwaad		5	Shale, greenish, sandy
		St. Peter		20-300	Sandstane, white

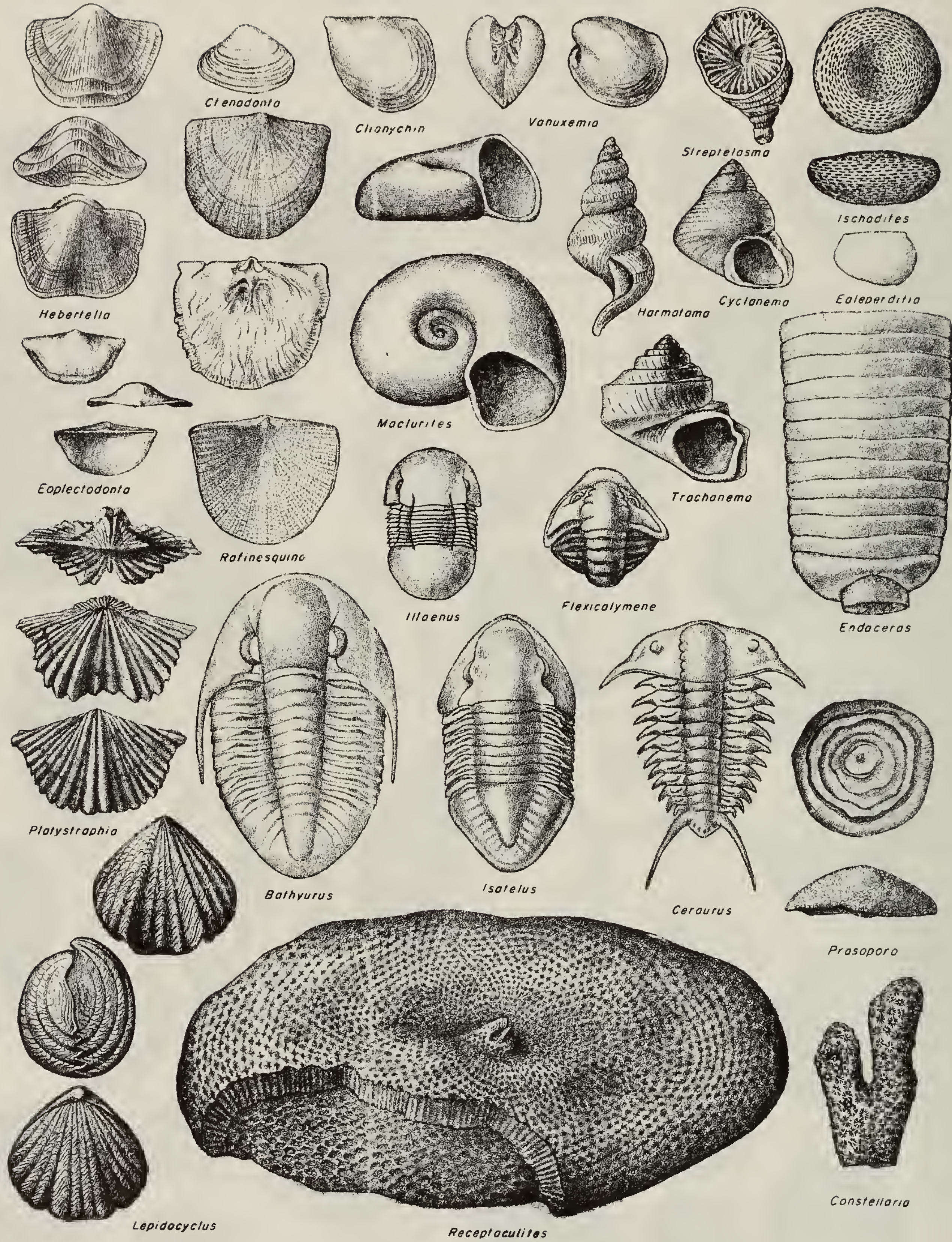


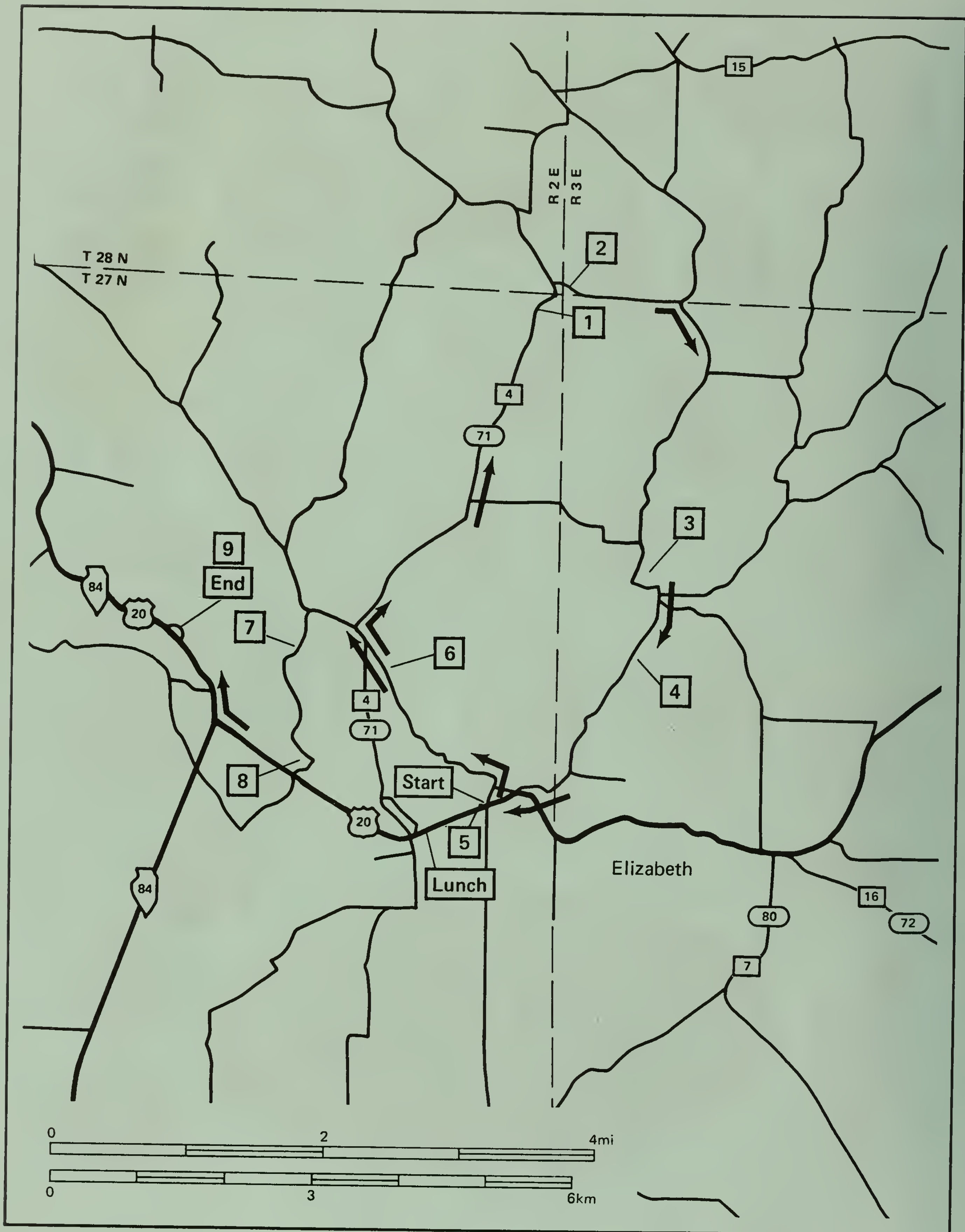


REPRESENTATIVE SILURIAN FOSSILS FROM NORTHWESTERN ILLINOIS



ORDOVICIAN FOSSILS





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